WK2

Coherence Properties of Hard X-ray Synchrotron Sources and X-ray Free Electron Lasers

I.A. Vartaniants

Deutsches Electronen-Synchrotron (DESY), D-22607 Hamburg, Germany

A general theoretical approach based on the results of statistical optics is used for the analysis of the transverse coherence properties of third-generation hard X-ray synchrotron sources and X-ray free-electron lasers (XFELs). Correlation properties of the wavefields are calculated at different distances from an equivalent Gaussian Schell-model source. This model is used to describe coherence properties of a typical undulator source at the synchrotron storage ring. In the case of XFEL sources the decomposition of the statistical fields into a sum of independently propagating transverse modes is used for the analysis of the coherence properties of these new sources. A detailed calculation is performed for the parameters of a typical hard X-ray undulator planned at the European XFEL. It is demonstrated that only a few modes contribute significantly to the total radiation field of that source. Recent results on application of these coherent beams for coherent X-ray diffraction imaging will be demonstrated.